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A STUDY OF THE SAND-DUNES ON THE SHORE OF LAKE MICHIGAN

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[Perhaps the most popular and most interesting field trip of the year for the School of Education is to the dunes in northern Indiana on the shore of Lake Michigan. Beginning with a narrow strip of low sand ridges near South Shore within the limits of Chicago, they increase in height in a gradually widening belt which circles the lower end of the lake. In the widest part, the farther edge of the dunes is about two miles from the shore.

Opportunity is frequently offered for pupils to study the work of water in its action upon the earth's surface, but striking examples of wind-action are far more rare. In the dune area, however, the work of each season is easily measured by observing the growth of the annuals at the base of the advancing sand flood. Many of the taller kinds, such as bulrushes in the marshes, will be found buried to their tips and to a depth of three or four feet. Since these began to grow this season, the amount of sand moved, and its rate of movement may be easily observed. If not too moist, the movement may be detected before one's very eyes. By turning a pail or box on its side facing the wind, it will soon catch a quantity of sand that is being shifted by the breeze. By placing the face close to the surface on a dry day, one can notice that the air six inches to a foot above the surface has a fog-like appearance owing to the sand that is being carried along.

As may be imagined, the plants that grow here show many interesting adaptations to these uncertain and extreme conditions. The same may be said of the animals. Roots in treetops are not uncommon, while branches now protruding from the sand give a clue as to the cause of this strange and apparently unnatural growth.

The industrial aspect of the dunes is of no less importance. Thousands of carloads of sand, removing hundreds of acres of dunes in some places a hundred feet deep, have been brought to the city for the purpose of railroad track elevation. Without this enormous supply of filling close at hand, it is difficult to see just how the railroad companies would have met the track-elevation problem.

The scenic side of the trip is not the least of its attractions. The dark verdure of the pines, and the yellow sand against a background of deep blue in the lake and sky, form a picture never to be forgotten. While one might be inclined to associate the dunes with burning sands of the desert, the fact is that one is rarely uncomfortable from heat, as the lake breeze almost invariably holds the temperature within reasonable limits.

To assist the older pupils in a study of the dunes they are provided with the following outline of suggestions.— NOTE BY THE EDITOR.]

AN OUTLINE FOR FIELD-STUDY IN THE MILLER'S-DUNE PARK AREA

I. MATERIALS.— Provide yourself with a basket or strong pasteboard box, a strong knife, a garden trowel, a wide-mouthed bottle or pint Mason jar, a compass; if possible, a clinometer; a notebook with writing and drawing paper.

II. PREPARATORY.— Find the geographic location of the region with reference to Chicago and Lake Michigan; the distance from Chicago, and the course of the Lake Shore Railway in reaching it. See topographic map, "Tolleston Quadrangle" (*Twenty-second Report of the Indiana Geological Survey,* Lake & Porter Co.).

III. OBSERVATIONS EN ROUTE.— Topography of the country between Chicago and Dune Park: (1) area dominated by level, low prairie; (2) area of alternating flats or depressions and ridges; (3) area of irregular hills and depressions; (4) area of raw sand-dunes. Relation of depressions or lagoons, as to direction, to each other and to the lake. The character of the plant life dominating the various type areas (prairie, ridge, marsh, wet flats, dunes). Get a view of the Calumet River valley.

NOTE.— Always designate the place of observation as, Indiana Harbor to Pine, low dunes, long river-like lagoons, scrub pine, etc.; or indicate the station at which the observation is recorded, as, *Pine:*

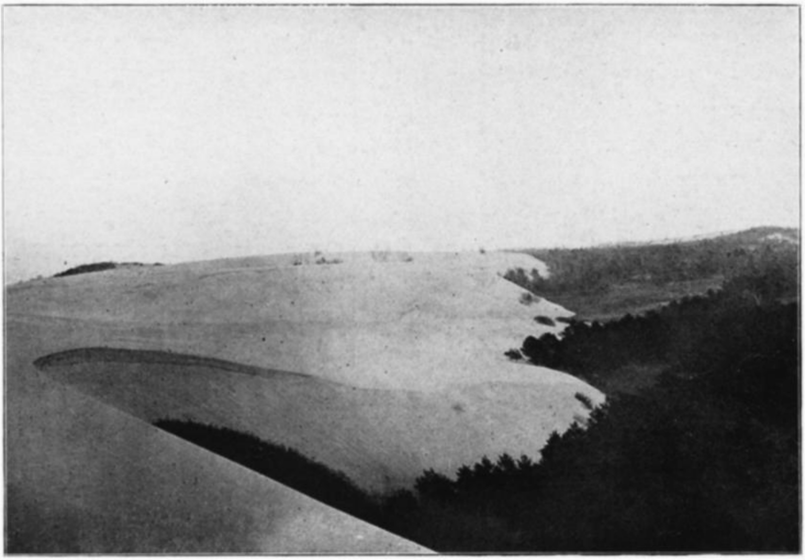
IV. AT DUNE PARK.— (1) Get a good impression of the topography of the whole country around Dune Park. (Upon reaching the crest of a hill, locate the directions by using your compass, and make a note of the character of the country, as far as you can see, to the north, south, east, and west.) (2) Try to determine how large an area has been stripped of sand by the Sand Company. Note the plants found growing on this portion from which sand has been taken.

Hills.—(1) Note the general character of the wooded hills. (2) Find where a cut reveals a section of the hill, and examine the mineral material, the height of hill, the character of slopes; inference as to how these hills were formed; proof. (3) Examine the fringe of plant roots at the surface part of the cut; length, depth, abundance of roots. (4) Look for old soil lines along the sides of the cut. (5) Make a list of the dominant plants found on the wooded ridges. (6) Is there any difference in the vegetation on the south and north slopes of these hills? (7) Notice and account for the cone-shaped depressions among these hills. (8) Watch for signs of animal life in this region.

Marshes and flats.—(1) From the crest or side of the hill get a view of the whole marsh. (2) Notice the various groups or zones of vegetation. (3) Approaching the marsh, make a list of the plants dominating each zone. (4) Note where the plants of the hills cease and the plants of the marsh begin; is this change gradual or abrupt; examine the soil, collect samples to a depth of eight or ten inches. (5) Examine the swamp for animal life—birds, reptiles, frogs, insects, etc. (6) Examine the soil thrown up while cutting the ditch through this marsh; from the nature of this material and the position of the marsh try to determine its origin.

Bare dunes at base.— (1) Estimate the height of the dune. (2) Measure the steepness (angle) of the slope. (3) Notice any movement of the sand on the slope, how and why it moves. (Note: Find a place where sand has not been disturbed by the Sand Company.) (4) Examine the border line between the bare dunes and the vegetated area. (5) Compare the plants found on the old or vegetated area with those growing within the barren dune; what inferences? (6) Examine the roots of trees, where bared, along the crest of the bare dunes; estimate the volume of earth penetrated by the roots.

On the bare dune.—Where does all this sand come from? (1) Notice the surface appearance of the bare dunes; steep slopes, gradual slopes, cuts, crests. Do the ridge crests extend in one direction or in various directions? Do the steep slopes face in the same direction or in various directions? Do the depressions,



THE ADVANCING DUNES COVERING A FOREST

"blow-outs," extend in the same directions or in various directions? Work out how this surface was made, and show how these regularities or irregularities of surface came to be. (2) Observe along the surface of the sand evidences of sand being moved by the wind; how moved? (3) Where is sand being blown by the wind? where deposited? how is this determined? (4) Try to determine how this sand first begins to pile up or drift (look for evidence around clumps of plants, old logs, and stumps). (5) On which side does the sand drift with reference to the direction of the wind (6) Show how one of these small drifts may grow into a large dune. Give the story of the growth of this dune region.

V. (1) Account for the presence of growing trees on these barren dunes. (2) What is the meaning of the groups of dead, decaying tree trunks? (3) Make a list of the plants (*a*) that can grow on these barren dunes; (*b*) that can live while being buried or unburied by the sand; (*c*) that are killed when sand begins to bury them. (4) Examine the base of growing and dead plants, to see whether they have been affected by the wind-blown sand.

VI. "THE CRATER."—(1) Get a good view of the country from the top of "The Crater;" of the shore-line. Try to locate South Chicago and Michigan City, the Calumet River, the Valparaiso Moraine. Are there any dunes south of the Calumet River? (2) Try to account for this crater-hill so near to the lake. (3) The character of the hill and the condition of vegetation on the east and northeast sides of the hill, on the south and southwest sides, on the inside of the crater; account for these differences. (4) The meaning of the depression at the west base of the crater; your evidence. (5) The meaning of the high barren dune just west of this depression. (6) The kind of plants growing on this high dune; how do they influence the dune?

VII. THE BEACH.—(1) Can you find any evidence that the water delivers this dune sand? (*a*) Can you see the waves actually depositing any sand on the beach? (*b*) Do you find any materials in or along the edge of the lake from which sand might be made? (*c*) Can you detect any wave-action which would manufacture sand out of this material? (2) When waves approach the shore, do they bring any materials with them? When the water of the wave returns, does it take any material back with it? (3) How wide is the beach? Do the waves ever wash over the whole beach? Evidence. Make list. (4) What plants are able to live on this beach? (5) What animals find a living along the beach? What food do they find along the shore?

VIII. Collect and bring to the classroom the characteristic plants of (1) the beach; (2) the barren dune; (3) the vegetated dune; (4) the pine flat; (5) the marsh; (6) any animal life found in these areas; (7) the principal varieties of stones found on the beach; (8) kinds of soil.